Segmenting the Market for Electric Vehicles in India

Authors :

Nisarg Patel

Gaurav Deore

Harsh Priyam

Aradhya Kanth

Sania Shaikh

[Project Github Repository](#)

Overview

The process of marketing segmentation involves the identifying of variations in customer needs and the determining of how these needs can be fulfilled. Customers may differ in many ways; wants, purchasing power, geographical location, attitudes, personality, knowledge, benefits sought, and/or habits. Hence, by identifying specific groups within a market, a market campaign for a product or service can be more fine- tuned to fit specific segments. Besides usual socio-demographic variables, psycho-graphic and behavioral variables were included to identify specific market segments.

In this report we provide the extensive data driven segmentation of the Indian EV market for any business to launch their product strategically in the market.

Fermi Estimation

Based on current data as of 2022, it is estimated that the electric vehicle (EV) market in India is growing rapidly. According to the Society of Indian Automobile Manufacturers, sales of EVs in India increased by **126%** in the fiscal year **2021** compared to the previous year. In addition, the **government of India has set a target of achieving 30% EV penetration by 2030.**

Using this information, it is difficult to estimate the exact percentage of Indians who will have EVs by the end of 2023. However, we can make an educated guess based on the current rate of growth in the market. Assuming that the growth rate continues to be around 126% per year, and that there are currently around 1.4 billion people in India, then it is possible that around 6-8 million people could have EVs by the end of 2023.

Assuming there are approximately 1.4 billion people in India, and assuming that only people **over the age of 18 and under the age of 60 are in the working class**, that would make around 840 million people in the working class. **Assuming that the employment rate is around 50%,** that would mean that around **420 million people are employed**.

Assuming that only people in the **middle and upper classes** can afford to buy electric vehicles, that would be around **20% of the employed population or 84 million people**.

Assuming that only 10% of those people are willing to buy an electric vehicle, that would be around 8.4 million people.

It's important to note that this is a rough estimate, and there are many factors that could impact the actual number of EVs on the road in India. However, it's clear that the EV market in India is growing rapidly, and it will be interesting to see how it develops over the coming years.

Data Collection and Preparation

In Total we used 12 raw datasets collected from various **authentic sources**.

- EV companies registered with number of vehicle sold by the company till (2022)
- Total charging stations sanctioned by gov till 2023 state wise
- Number of charging facilities available up till 2022
- Contains the sales of all types of automobiles till 2015 category wise
- Comprises of total electric and non electric vehicle sales as on April 2022 state wise
- Comprises of total operating charging stations with their type and precise location city wise.
- State wise Electric Vehicles Supported under Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India (FAME-India) Scheme as on 09-12-2021
- Ratings of different EV company products.
- Consumers data purchasing automobiles.
- State wise classification of types of automobiles with their numbers.
- US consumer characteristic data

Other datasets were obtained using web scraping

- The data has been scraped from bikewale for 2-wheeler EV, containing user preferences.
- The data has been scraped from car wale for 4-wheeler EV , containing user preferences.

[Click here to access all the datasets and their descriptions.](#)

Data Preparation

First we cleaned the collected datasets by removing any irrelevant data, duplicates, and missing values and checked the consistency of the data in all datasets. **(Cleaning)**

Then we combine the cleaned datasets based on their common fields. For example, EV companies registered with the number of vehicles sold by the company till 2022 are integrated with ratings of different EV company products. **(Integration)**

Then we apply certain transformations so that to convert the raw datasets into a format suitable for analysis. For instance, the total charging stations sanctioned by the government till 2023 state-wise is transformed into the number of charging stations per 1000 vehicles in each state. **(Transformation)**

After Transformation we added relevant information to the datasets to provide additional context for analysis. For example, the state-wise electric vehicles supported under Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India (FAME-India) Scheme as of 09-12-2021 is enriched with the sales of electric vehicles in each state so that to get a fuller context. **(Enrichment)**

- [All the relevant python code used for data preparation can be found here.](#)
- [Final Datasets prepared after cleaning,transforming,enrichment and integration can be found here.](#)

The data is then used to segment the market based on various factors such as **consumer preferences, sales trends, charging infrastructure, government policies and some environmental factors such as geographic location or climate change concerns etc.**
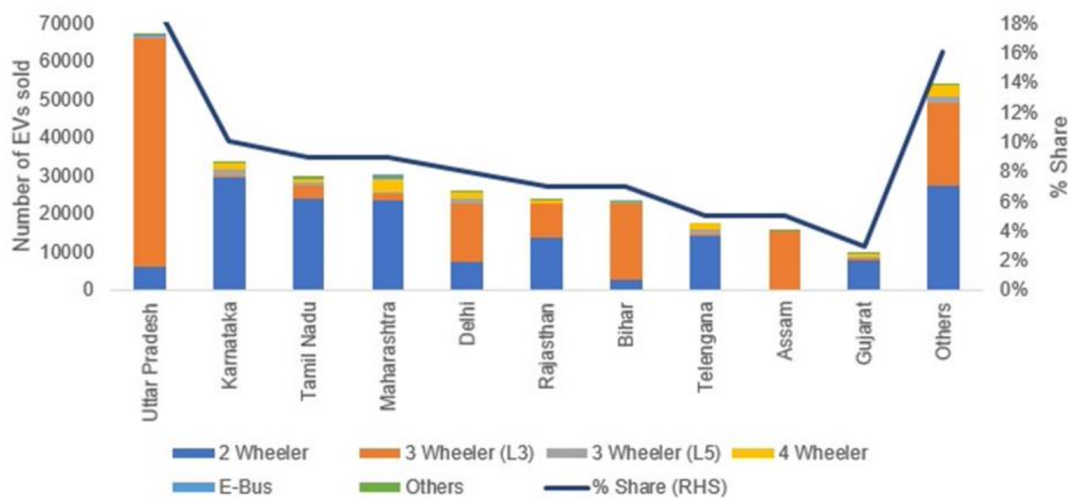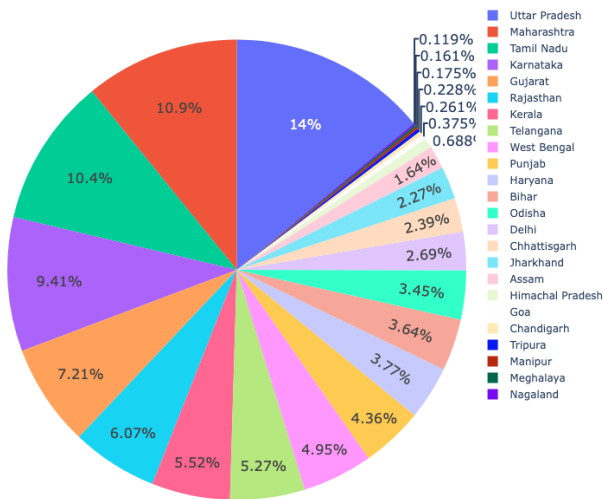
Data driven Market Analysis

The Indian EV market is rapidly growing, driven by consumer preferences, sales trends, charging infrastructure, government policies, and environmental factors such as climate change concerns.
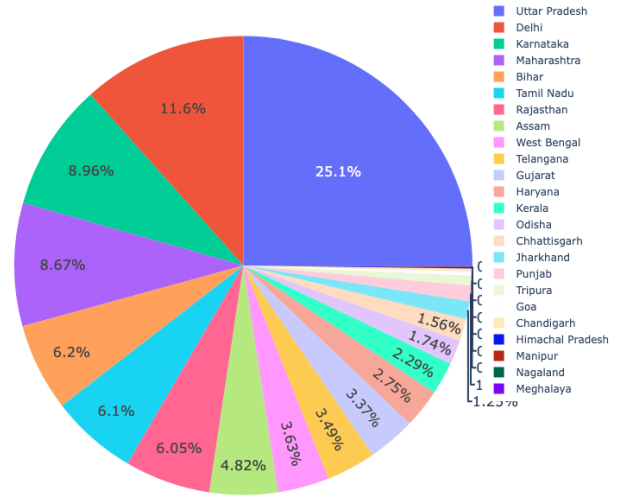
Measurement Scales

1. Sales trends

   According to our analysis the sales of EVs in India grew by 20% in FY 2020-21, despite the challenges posed by the COVID-19 pandemic. Electric two-wheelers dominated the market, accounting for over 95% of the total EV sales, while electric cars and buses are also gaining traction

Total Non-Electric Vehicle

Legend (Non-Electric Vehicle): Uttar Pradesh, Maharashtra, Tamil Nadu, Karnataka, Gujarat, Rajasthan, Kerala, Telangana, West Bengal, Punjab, Haryana, Bihar, Odisha, Chhattisgarh, Jharkhand, Assam, Himachal Pradesh, Goa, Chandigarh, Tripura, Manipur, Meghalaya, Nagaland

Values: 14%, 10.9%, 10.4%, 9.41%, 7.21%, 6.07%, 5.52%, 5.27%, 4.95%, 4.36%, 3.77%, 3.64%, 3.45%, 2.69%, 2.39%, 2.27%, 1.64%, 0.688%, 0.375%, 0.261%, 0.228%, 0.175%, 0.161%, 0.119%

Total Electric Vehicle

Legend (Electric Vehicle): Uttar Pradesh, Delhi, Karnataka, Maharashtra, Bihar, Tamil Nadu, Rajasthan, Assam, West Bengal, Telangana, Gujarat, Haryana, Kerala, Odisha, Chhattisgarh, Punjab, Tripura, Goa, Chandigarh, Himachal Pradesh, Manipur, Nagaland, Meghalaya

Values: 25.1%, 11.6%, 8.96%, 8.67%, 6.2%, 6.1%, 6.05%, 4.82%, 3.63%, 3.49%, 3.37%, 2.75%, 2.29%, 1.74%, 1.56%, 1.25%

It can be observed that states dominating Total Non-Electric Vehicle i.e to say which compose 75% total sales includes UP , Maharashtra , Tamil Nadu , Karnataka , Gujarat , Rajasthan , Kerala , Telangana , West Bengal , Punjab , Delhi are not on nearly one to one correspondence with total electric vehicles which consists of UP , Delhi , Karnataka , Maharashtra , Bihar , Tamil Nadu , Rajasthan assam.

This suggests that there is an opportunity to target the states with high non-electric vehicle sales and low electric vehicle sales in order to convert consumers and gain early market dominance. By using a geographic segmentation strategy, businesses can focus their efforts on these states and tailor their marketing campaigns and products accordingly. This can help to accelerate the adoption of electric vehicles in these states and establish a foothold in the market.

In conclusion, targeting states with high non-electric vehicle sales and low electric vehicle sales can be an effective strategy for businesses looking to gain early market dominance in the electric vehicle industry in India. A geographic segmentation approach can be used to identify these states and tailor marketing efforts accordingly.

2. Charging Infrastructure

Upon performing preliminary analysis of data regarding the number of EV charging stations , distributed across various states in India, we can see that the nationwide distribution is represented as follows:

Number of Charging Stations
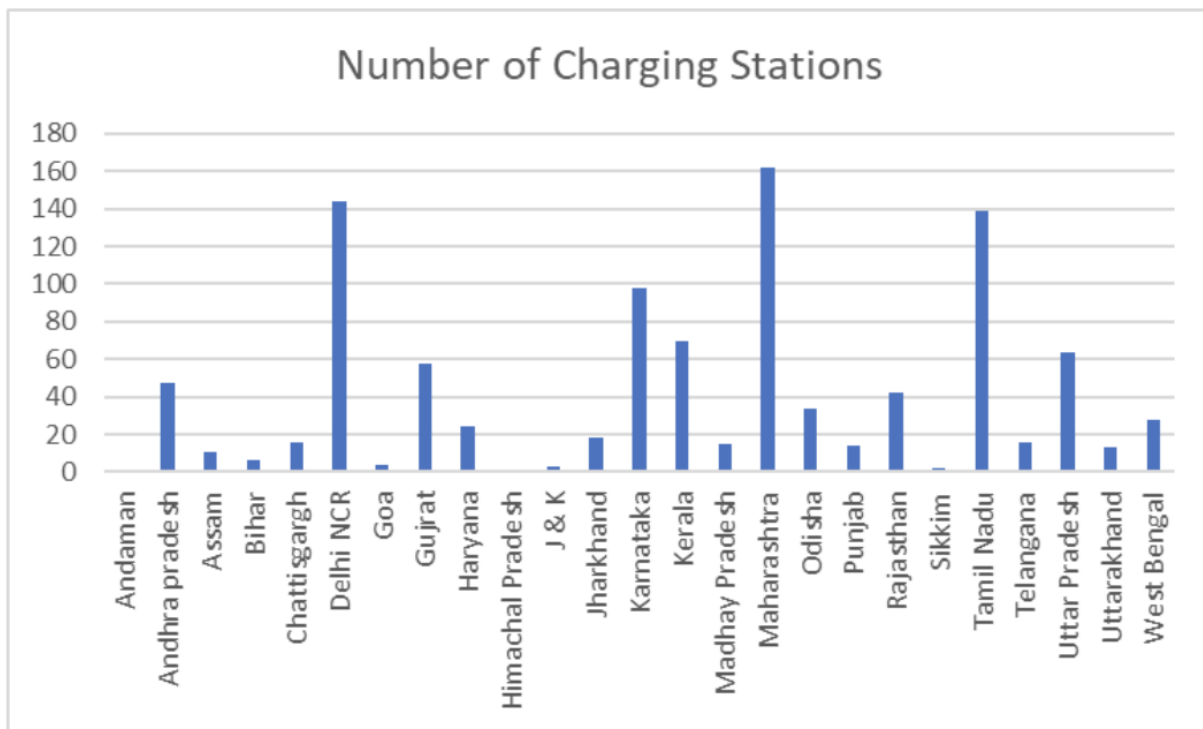
- Maharashtra has the highest number of EV charging stations, which is 162.
- The second highest number is that of Delhi at 144 charging stations.
- This is followed by Tamil Nadu at 139 stations.
- Whereas Sikkim, Jammu & Kashmir as well as Goa have the least number of charging stations.
- It was also observed that metro cities such as Mumbai, Delhi and Bangalore were the cities having the highest number of charging stations.

3. Govt Policies

Government policies also play a role in market segmentation. The data on state-wise electric vehicles supported under FAME-India Scheme can be used to identify the states where the government is actively promoting electric vehicles. This information can be used to target marketing efforts and incentives in those states to encourage the adoption of electric vehicles.

Total EV supported by state for adoption and manufacturing
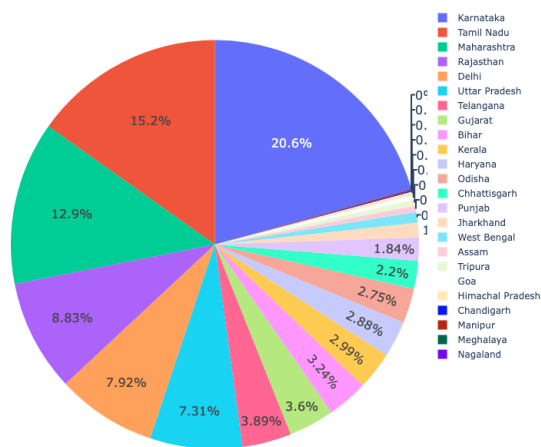
It can be seen that most states promoting and providing incentives to both consumers and businesses producing ev products includes Karnataka , Tamil Nadu , Maharashtra , Rajasthan , Delhi , UP , Telangana , Gujarat , this is an important aspect which should be taken into consideration while segmenting the market.

4. Consumer preferences

The Indian Electric Vehicle Market is segmented by Vehicle Type and Power Source.
• By Vehicle Type, the market is segmented into Passenger Cars, Commercial Vehicles, and Two- and Three-wheelers.
• By Power Source Type, the market is segmented into Battery Electric Vehicle, Plug-in Electric Vehicle, and Hybrid Electric Vehicle. Our report mainly focuses on the Indian

Electric Vehicle Market segmented by Vehicle Type. However, accessibility to Power Sources for Electric Vehicles affects the market and would be slightly discussed in the report.

The Indian Electric Vehicle Market was valued at USD 5 billion in 2020, and it is expected to reach USD 47 billion by 2026, registering a compound annual growth rate (CAGR) of above 44% during the forecast period (2021-2026). The Indian Electric Vehicle Market has been impacted by the outbreak of the COVID-19 pandemic due to supply chain disruptions and halt of manufacturing units due to continuous lockdowns and travel restrictions across the country. However, the electric vehicle (EV) market is still in its nascent stage in India. It is expected to grow at a much faster rate during the forecast period due to various government initiatives and policies.

E-commerce companies (Amazon, for example) are launching initiatives to use e-Mobility for last-mile deliveries to reduce carbon footprint. India is experimenting with e-Mobility for public transport, and the country has deployed electric intercity buses across some major cities. In addition, state governments are also playing an active role in the deployment of policies encouraging the usage of EVs. For instance,

• Kerala aims to put one million EV units on the road by 2022 and 6,000 ebuses in public transport by 2025.
• Telangana aims to have EV sales targets for 2025 to achieve 80% 2- and 3- wheelers (motorcycles, scooters, auto-rickshaws), 70% commercial cars (ride- hailing companies, such as Ola and Uber), 40% buses, 30% private cars, and 15% electrification of all vehicles.

India is also pushing hard for the electrification of buses. Many state governments have already started procuring electric buses from Chinese and local electric bus manufacturers. Many local bus manufacturers who are in collaboration with some Chinese manufacturers are trying to cater to the rising demand for electric buses in India. With transportation still being a challenge in India, a lot of people in these segments look forward to the two-wheeler industry in India. As a result of the surging pollution, the national government has launched stringent policies to curb vehicular emissions. Furthermore, the availability of a considerable number of electric two-wheeler models, their low cost, as well as their availability as a substitute for conventional

fuel-based vehicles. These aforementioned factors are fuelling the demand in the Indian electric vehicle market.
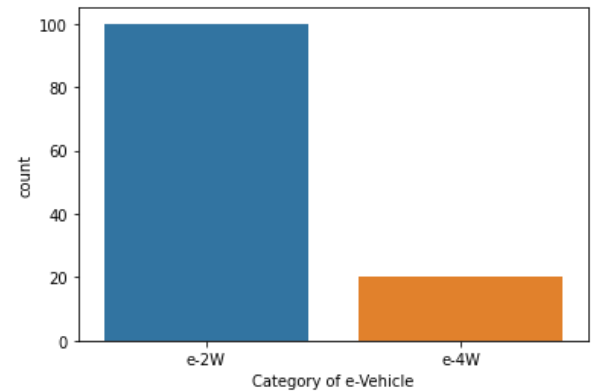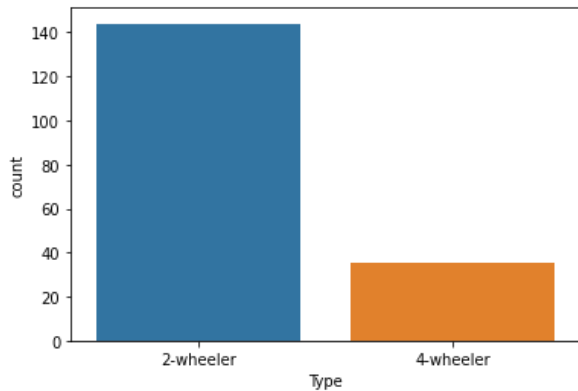
Total EV sales are dominated by E3W and E2W (i.e., three-wheelers and two- wheelers). So, when starting an EV business, one can also decide in which segment they want to provide EV's for maximum initial sales and fast growth.
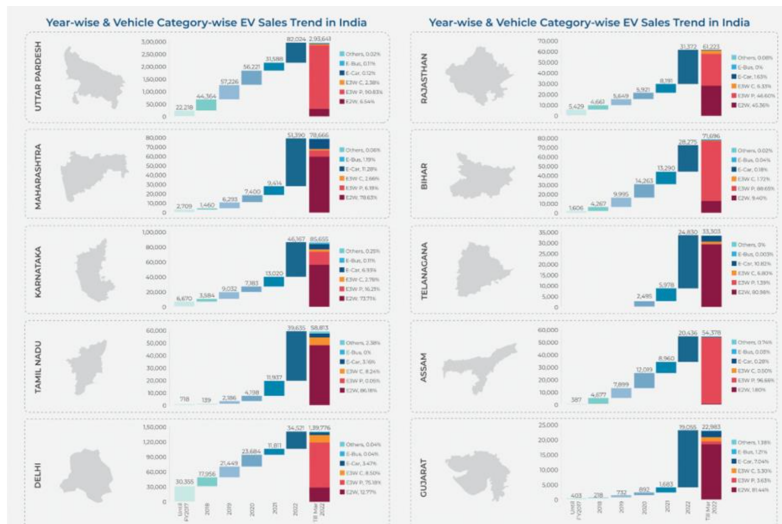
If we look at the top states in EV sales closely, some important insights we can make from the available data :

- UP leads the number in total EV sales but most sales are in the 3-wheeler segment i.e., for transport.
- Tamil Nadu has the highest percentage of two-wheeler EV sales of the total sales in that state i.e., 86%.
- Maharashtra has the highest percentage of four-wheeler EV sales of the total sales in those states i.e., 11%.

5. Consumer Characteristics

One of the important factors that can be used for segmentation is consumer characteristics, which includes factors such as age, income, education, and lifestyle. By analyzing the consumer data purchasing automobiles, we can identify the target market for electric vehicles based on consumer characteristics.
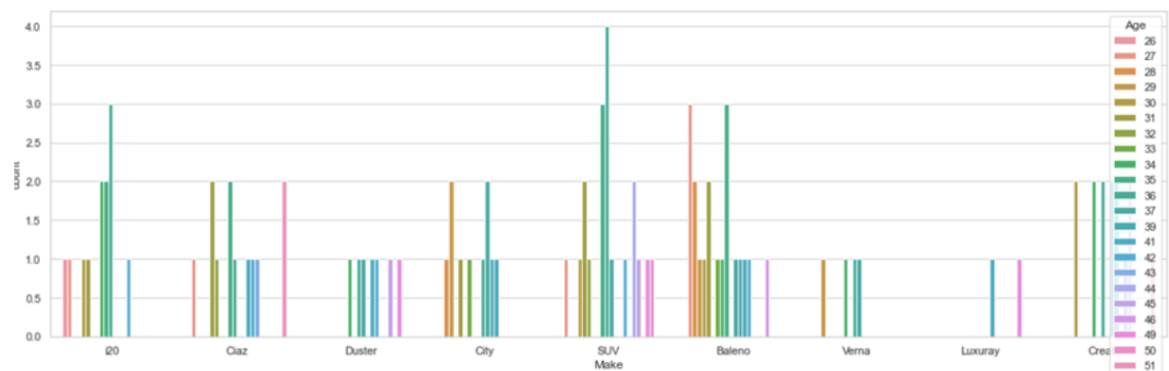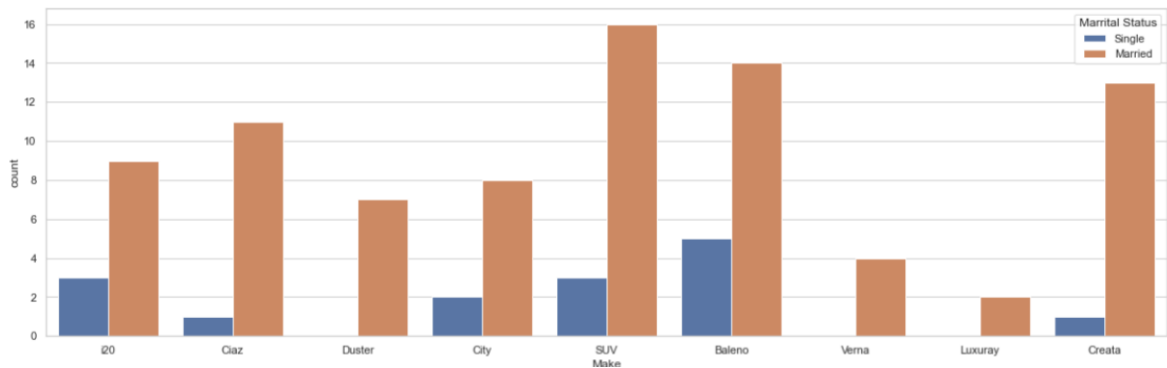

Plot for Relationship between consumers age and the vehicles they purchase
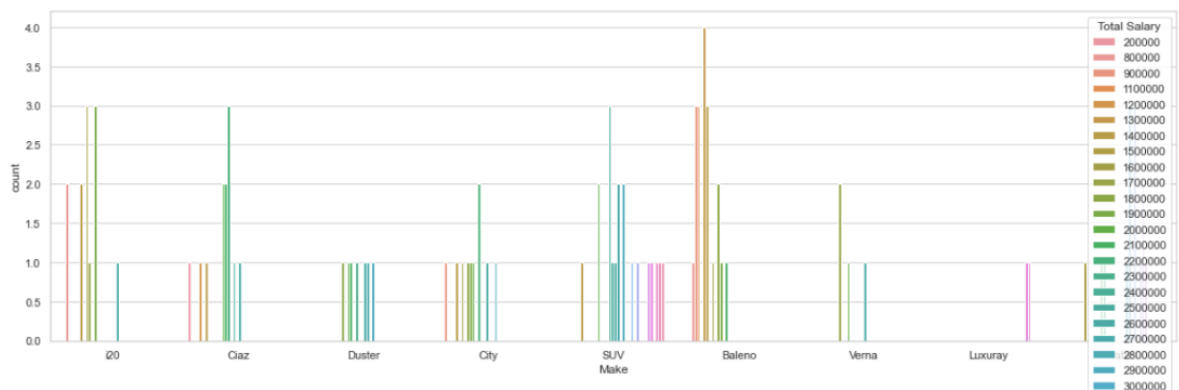
Observations:
- **Age** : Younger consumers buy cheaper cars.
- **Number of dependents** : More dependents make consumers buy cars with more seats, so they prefer SUVs.
- **Salary :** If you fit the normal salary chart with the price chart, you'll notice that the average violin salary chart corresponds to the price of the car, which is a very direct relationship.

People in their 30s including early 40s and late 20s tend to buy electric vehicles comparatively more than others.

Plot for Relation between consumers' marital status and the vehicles they purchase.

Observation: From the above plot it is clearly notable that married persons are more likely to purchase an electric vehicle when compared to a single person.


Plot for Relation between consumer's total salary and the vehicles they purchase.

Observation: From the above plot we can analyze that salary is directly proportional to the type of Electric vehicle a person tends to buy.
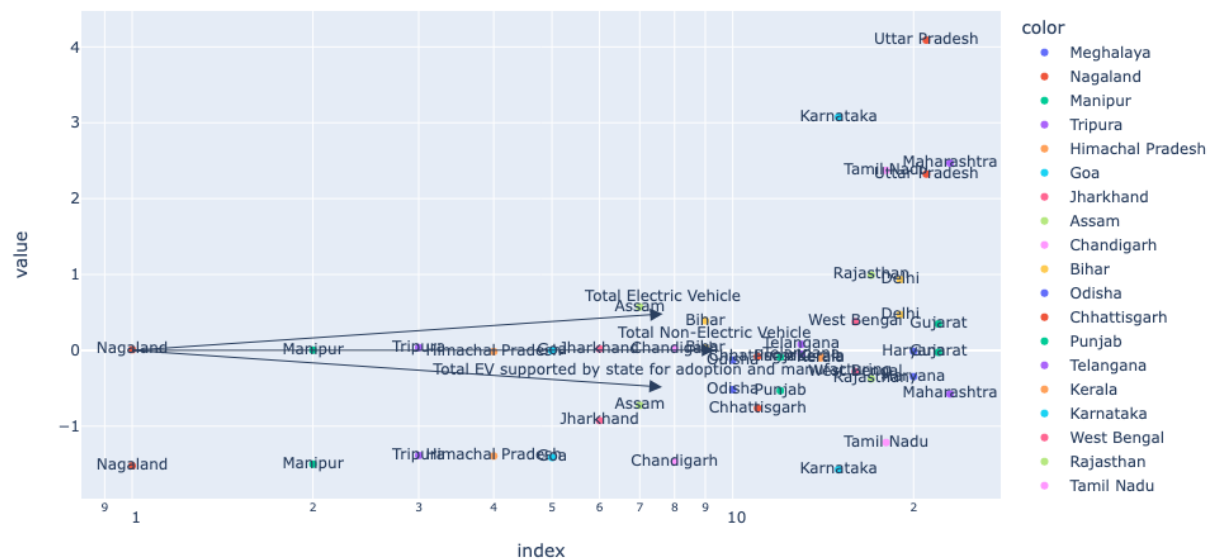
Segmentations And Profiling

1. Segmenting Market based on sales , charging Infrastructure , govt policies

Using PCA on the combined dataset of this three features , we found two first PCA accounts for total 80% of variation
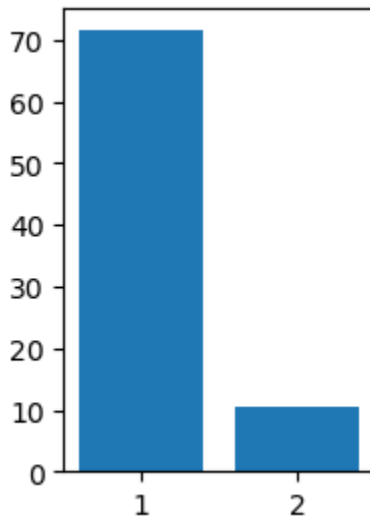
Plotting the 2D PCA for the above PCAs , the observations for which have been described in Data driven market analysis sections.

Finally the Elbow method suggests that the amount of efficient clusters should be three which is also in line with our findings.
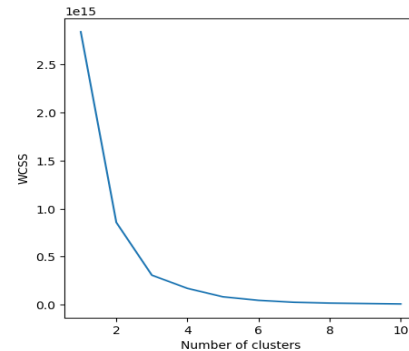
Based on that we perform k means clustering to cluster the PCA plot into three groups or segments of states.

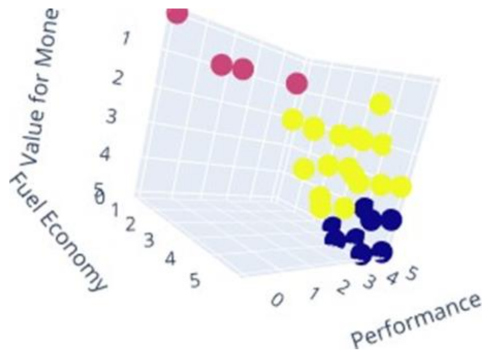State EV (PCA and k-means clustering with 3 clusters)

- **Segment 1** - Uttar Pradesh , Karnataka , Maharashtra , Tamil Nadu
    - States with high number of both electric and non-electric vehicles
- **Segment 2** - Rajasthan ,Gujarat , Madhya Pradesh , Andhra pradesh , Kerala , Telangana , West Bengal , Haryana , Bihar , Delhi
    - States with high number of Non-electric but low number of electric vehicles
- **Segment 3** - Assam , Chhattisgarh and rest.
    - States with low amounts of both electric and non-electric vehicles.

2. Segmenting Market based on Consumer preferences and Characteristics.
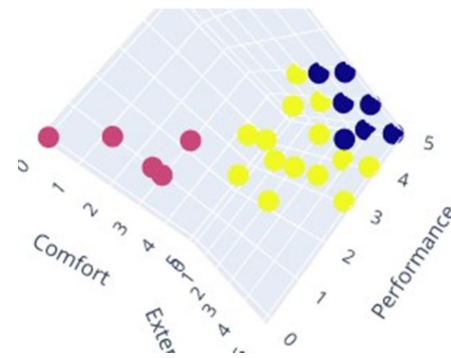
    Using Dendrograms suggests that optimal cluster size should be 3.

Value for money , fuel Economy , Performance   comfort , exterior , performance

Segment 1, which values fuel economy and value for money over performance, may include people who are price-conscious and are looking for practical vehicles that are economical to run. This segment could include people of all ages and classes, but may be more prevalent among those who are budget-conscious or who prioritize practicality over luxury.

Segment 2, which considers all factors equally, is harder to characterize without additional information. It may include people who prioritize a balance between practicality, performance, and luxury, and could include a broad range of ages and classes.

Segment 3, which values performance and exterior look over other factors, may include people who prioritize style and performance in their vehicles. This segment may include younger, more affluent consumers who are willing to pay a premium for luxury or high-performance vehicles.

Conclusions

Nisarg Patel

Our analysis suggests that there is a notable disparity in the sales of electric and non-electric vehicles across different states in India. Specifically, states such as **Rajasthan, Gujarat, Madhya Pradesh, Andhra Pradesh**, Kerala, Telangana, West Bengal, Haryana, Bihar, and Delhi **exhibit high sales of non-electric vehicles but low sales of electric vehicles.** This segment of states, identified as segment 2, presents an opportunity for targeted marketing efforts and incentives aimed at encouraging the adoption of electric vehicles. The low level of EV adoption in these states signifies a significant market potential that can be harnessed by companies seeking to launch EV products.

Sania Shaikh

Upon analysis of the data and assuming that the number of charging stations indicate proportionally the number of Electric vehicle being used in a particular area, we can conclude that the most profitable state for **launching an electronic vehicle** would be **Maharashtra closely followed by Delhi and Tamil Nadu**. On the other hand, much profit cannot be expected in states like Sikkim, Jammu and Kashmir or Goa. Cities that would have an eager customer base would be Mumbai, Delhi as well as Bangalore.

Gaurav Deore
- Based on our analysis, it appears that individuals in the **age range of late 20s to early 40s** exhibit a higher propensity to purchase electric vehicles when compared to other age groups.
- Moreover, our findings suggest that **married individuals** are more inclined to purchase an electric vehicle compared to single individuals.
- Additionally, there seems to be a correlation between a person's salary and the type of electric vehicle they are likely to purchase, with **higher salaries** being associated with the purchase of more expensive electric vehicles as well as **more tendency of buying one.**

Harsh Priyam

- For E2Ws:
  - So, from the analysis we can see that the company can target for E2W's vehicles in many parts of the country as many states have reported high E2W sales, but the most favorable location seems to be southern India as many states there like Karnataka, Tamil Nadu, Telangana, Kerala has high percentage sales of E2Ws of the total EV sales also they have high numbers of charging stations which makes convenient for the customer to adopt an EV.
- For E4Ws:
  - So, from the analysis we can see that the company can target for E4W's vehicles in many parts of the country as many states have reported high E4W sales, but the most favorable location again seems to be southern India as many states there like Karnataka, Tamil Nadu, Telangana, Kerala has high percentage sales of E4Ws of the total EV sales and they have high numbers of charging stations which makes convenient for the customer to adopt an EV.

Aradhya Kanth

- The company should focus on many aspects of the vehicle , especially on reliability, comfort and service cost, as most people use the vehicle for daily commute and hence provide suitable customer experience. Age doesn't seem to matter as people from every age group are
- interested to adopt E2W's there is definitely anxiety in terms of range, service costs and safety of battery which have been already mentioned. If the company can solve those issues, it would help in building customer trust, which would eventually help grow the business.
- The company should focus on other aspects of vehicles, such Performance, Range and service cost, as people buy cars for the long term. Age doesn't seem to matter as people from every age group are interested to adopt E4W's, there is definitely anxiety in terms of range, service costs and safety of battery which have been already mentioned if the company can solve those issues, it would help in building customer trust, which would eventually help grow the business.